



National Renewable Energy Laboratory

SOLICITATION FOR LETTERS OF INTEREST (LOI) NO. RDJ-1-30630-00

"THIN-FILM PHOTOVOLTAICS PARTNERSHIPS PROGRAM"

READ THIS DOCUMENT CAREFULLY

This solicitation is being conducted under the streamlined procedures for competitive Letters of Interest established by the National Renewable Energy Laboratory (NREL). NREL will select a LOI for potential subcontract award based on the following:

- All requirements being met
- THE BEST COMBINATION OF: TECHNICAL FACTORS (BASED ON QUALITATIVE MERIT CRITERIA) AND EVALUATED PRICE

Issue Date: January 16, 2001

Due Date: March 15, 2001, 5:00 pm. Mountain Time

*****Technical questions must be **received in writing** no later than **February 15, 2001** and can be faxed to Vicki Riddell (303) 384-7397, or sent via e-mail to vicki_riddell@nrel.gov *****

1. **Solicitation Type** Best Value Letters of Interest

Submit LOI Responses to and request information from the NREL LOI Contact below:

2. **NREL LOI Contact** National Renewable Energy Laboratory
Attn: Vicki Riddell, M/S 2713
Re: LOI No. RDJ-1-30630-00
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Golden, CO 80401-3393
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Electronic (PDF) copies of forms and appendices can be found at:

http://www.nrel.gov/contracts/rfp_related_docs/

3. INTRODUCTION/BACKGROUND

The National Renewable Energy Laboratory (NREL) invites you to submit a Letter of Interest (LOI) response for a research and development project entitled “Thin-Film Photovoltaics Partnership Program”(TFPPP) in accordance with the requirements and conditions set forth herein. NREL is a national laboratory operated for the Department of Energy under a teaming arrangement among the Midwest Research Institute, Battelle Memorial Institute, and Bechtel National, Inc. In addition to programs for Technology Partners and Research and Development (R&D) Partners, this competition also solicits for the University Center of Excellence program in thin films. The current University Center of Excellence subcontractor is the University of Delaware, Institute of Energy Conversion. Information on the University Center of Excellence may be found at: <http://www.udel.edu/iec/>

NREL plans to sustain support of thin-film R&D and to continue National R&D Team activities made up of academia, thin-film photovoltaic (PV) industry, NREL, and the National Center for Photovoltaics (NCPV) in the different thin-film PV technologies. The purpose of the TFPPP is to accelerate the progress of thin film solar cells and module development as well as to address mid- and long-term research and development issues. The long-term objective of the TFPPP is to demonstrate commercial, low-cost, reproducible, high yield and robust modules of 15% aperture-area efficiency. The purpose of this program is to make progress toward this objective by achieving aggressive interim goals in thin film module efficiencies; cell and module processing; cell and module reliability; and in the technology base that supports these key areas. For more background information on the NCPV, see the following web site:www.nrel.gov/ncpv

Existing NREL-sponsored National R&D Teams will be restructured around critical research issues after subcontract awards. All awardees must participate in National R&D Team activities, and a LOI response to this solicitation must indicate acceptance of this condition. National R&D Team meetings may require the sharing of proprietary information. NREL will be careful to respect each partner’s needs in any National R&D Team activities. Note that organization-specific R&D will take place in non-National R&D Team subcontract tasks, which in most cases (especially for industrial partners) shall be the majority of the total proposed effort.

The DOE/NREL/NCPV strategy in undertaking this initiative is to maintain the good coupling between laboratory results from fundamental materials and process research to manufacturing R&D, pilot-line operation, and commercialization of advanced thin-film PV products in the marketplace. The intent is to do this through cooperation with academia, U.S. thin film PV companies, and DOE laboratories. The initiative supports other DOE/NCPV activities by accelerating the marketplace availability of potentially low-cost PV technologies.

This solicitation is structured around three (3) types of participants: **Technology Partners, Research and Development (R&D) Partners, and a University Center of Excellence.** LOI responses will be separately evaluated within these distinct categories.

The following Table 1 summarizes the emphasis and focus of the three (3) categories:

| TABLE 1 - LOI CATEGORIES | |
|--|---|
| Category | Emphasis/Focus |
| Technology Partners | R&D and technology development concerning prototype/early commercialization modules and fabrication, Environment, Safety and Health, and stability issues that will support the commitment to near-term market entry of thin-film PV. |
| R&D Partners | Longer-term R&D to meet the long-term goals. |
| University Center of Excellence | Thin film solar cell research and support for industrial participants. |

For the purpose of this solicitation, thin films are defined as those based on the following light-absorbing semiconductor materials (and related alloys): amorphous silicon (a-Si), cadmium telluride (CdTe), copper indium diselenide (CIS), and film-silicon (film-Si) on low-cost substrates (silicon thickness <50 microns). No other PV technology will be considered under this LOI. Also, no multijunction device structures (with the exception of a-Si multijunctions) will be accepted (e.g., CdTe on CIS), as such combinations are part of the High Performance Photovoltaic Initiative. Proposals in the **Technology Partners** Category will be accepted in a-Si, CdTe, and CIS technologies only, as these technologies are in the first commercialization stage. Film-silicon under 50 microns has not demonstrated power modules thus far. Research in film-silicon on low-cost substrate cannot be proposed under the Technology Partners Category. Film-silicon research can be proposed only under the R&D Partners category since it is still in the R&D stage.

Because some activities are useful for more than one thin film (e.g. characterization, modeling, transparent conductors), NREL will accept such proposals. Responders are cautioned that such mixed proposals may be viewed with skepticism, since they might imply a lack of focus or commitment of the LOI responses. It is up to the Responder to define the proper focus of their proposed R&D, and to be convincing concerning their rationale.

4. OBJECTIVES

The objectives of this LOI are as follows:

- A. To support the successful introduction of U.S. thin-film PV products by addressing key near-term technical R&D issues at U.S. business concerns committed to thin-film PV technology;
- B. To support advanced (mid- and longer-term) thin-film R&D needed by industry for future product competitiveness, including improving module performance, cost per watt produced, and reliability of thin-film PV technologies.
- C. To support thin-film solar cell research through a University Center of Excellence for Photovoltaic Research and Education. The purpose of the University Center of Excellence category is to solicit accredited educational institutions to develop a program to further

advance thin film solar cell technologies through research and development; to assess and verify viable processing schemes through near state-of-the-art solar cells; to educate and train undergraduate and graduate students through solar cell fabrication and diagnoses; and to collaborate with U.S. thin film cell and module fabrication for improving processes, product performance, and cost.

In other words, the goal is to improve the likelihood of success of this generation of potentially low-cost thin film PV technologies, while keeping the “technology pipeline” full for future improvements.

In particular, the objectives are to accelerate the progress on the following aspects of thin-films based on a-Si, CdTe, CIS, and film-Si for module design: fabrication, solar conversion efficiency, size, cost, processing, and reliability, as well as ES&H issues. The fundamental understanding of these materials and devices in order to improve module performance and reliability, and to enhance the next generation of thin-film products, is also of interest. Some examples of key questions to be answered are: i) Can the Staebler-Wronski effect losses in a-Si materials and devices be eliminated or minimized from their current levels of 17% to 25% to further increase stabilized performance?, ii) What are the possible contact and junction degradation mechanisms in thin-film CdTe devices?, iii) Can CIS fabrication processes be improved in terms of cost and throughput?, iv) Can film-Si (less than 50 microns) be successfully fabricated on low-cost, foreign substrates, and then be monolithically integrated into thin-film modules?, v) Can the yield of all thin films in first-time module manufacturing be improved to acceptable levels?, vi) Can we assure the stability and long-term outdoor durability of thin film modules?

5. SCOPE OF INTEREST

Following are some of the technical issues that responses to the LOI should address:

Technology Partners shall emphasize those technical issues that improve module performance, module reliability, and low-cost processing. For **Technology Partners**, the major issues are:

- A. Improved module performance through efficiency improvements
- B. Improved module fabrication processes (including cost, throughput, and yield issues)
- C. Improved R&D base to support high-efficiency processing
- D. Alternate low-cost encapsulation approaches to reduce unit module cost and improve reliability
- E. In-situ process diagnostics and monitoring
- F. ES&H enhancements and recycling approaches as are appropriate to the technology
- G. Fundamental understanding and alleviation of degradation mechanisms in thin-film solar cells and modules
- H. Corporate commitment to near-term, high-volume manufacturing capability, and to use the knowledge-base developed during this Partnership Program in future low-cost, thin-film power and specialty products.

Some significant set of these major issues shall be addressed in the LOI response in order to be considered competitive for a **Technology Partner** award.

Examples of longer term R&D issues are as follows:

- A. Enhanced total-area thin-film solar cell efficiency and/or aperture-area submodule efficiency

- B. Potentially lower-cost, higher-throughput, large-area processing
- C. Fundamental research relating to the understanding of materials, improved device design, and modeling
- D. Innovative characterization and measurements tools
- E. Understanding of key solar cell and material-level changes that result in loss in performance, especially in a-Si and CdTe, and transient effects in CIS
- F. Novel and improved solar cell device structures, such as the use of thinner CIS and CdTe absorbers to reduce In and Te use, respectively.

LOI responses for **Technology Partners** are also encouraged to include about 20% of their research effort in longer-term R&D issues such as described above. It is encouraged that LOI responses include the proper amount of such R&D that is appropriate to their corporate needs (i.e., 20% is not an upper limit). This 20% may be part of the National R&D Team activities. These activities shall then form the basis for National R&D Team activities in cooperation with academic institutions and NREL. They will also represent an ongoing commitment to the development of improved thin-film technologies. To participate as a **Technology Partner**, business concerns shall have demonstrated fabrication of a 30-W thin-film module verified at NREL. (The module must be submitted to NREL for measurement, or already have been measured by NREL, prior to the end of the period for submitting this proposal.)

R&D Partners and the University Center of Excellence LOI responses may address some of the module-related issues (especially corporate **R&D Partners**), but are expected to focus on the longer-term R&D issues. It is also expected that a portion of the R&D partner activities will be coordinated with other National R&D Team activities.

The **University Center of Excellence**, in particular, is distinguished from all other university participants as addressing key issues and having the staff, equipment, and expertise capable of playing a major role in the Thin-Film PV Partnership. To participate in the University Center of Excellence category, academic groups shall have demonstrated excellence in science and technology in several thin films, including the demonstration of technology advances through solar cell fabrication. Research and development will include the investigation of increasing processing throughput while further enhancing device efficiencies using less expensive device designs and low-cost approaches. Baseline solar cell processing has been demonstrated under this category. Processes and device design must be based on fundamental understanding of device behavior and performance-limiting mechanisms. Successful Responders must demonstrate technology transfer through collaboration with industry and must advance thin film solar cell technology through education. In order to maximize potential technology sharing, Responders are discouraged from forming **exclusive** business relationships with any PV module manufacturer of such a nature that would prevent them from working with competing companies on R&D issues in the same or similar PV technology.

The following breakdown of the various tasks is meant only as examples to those technical issues that could be addressed in LOI responses. It is encouraged that LOI responses include creative and logical approaches to justify and support their various tasks. The following tasks are neither all encompassing, nor do they rigidly define the tasks best suited to individual LOI responses. LOI responses should provide a Statement of Work suitable to the organization's capabilities and priorities as they harmonize with the thin-film goals and objectives of the U.S. National Photovoltaics Program Plan, for 2000 to 2004 and this LOI. The Program Plan may be viewed at:

<http://www.nrel.gov/ncpv/pdfs/25847.pdf>

Task 1: Materials Research and Device Development

Device structures shall be optimized for high-efficiency solar cell and module performance. The various layers of the solar cell and module such as transparent conductors (e.g., SnO_2 , Cd_2SnO_4 , ITO, ZnO, etc.), heterojunction partners (e.g., CdS, CdZnS, ZnS, ZnSe, ZIS, etc.), absorber layers (a-Si, CdTe and related alloys and materials, CIS and related alloys and materials, CIGS, CIGSS, film-Si), back contacts including back reflectors (e.g., Ni, Ni/Al, ZnTe/Metal, graphite, Mo), and substrates (e.g., polymer, metal foil, stainless steel, and soda-lime glass) shall be optimized to achieve high performance. Alternate back contacts could also be evaluated and tested. In the case of film-Si, various layers of the devices could be optimized, such as the foreign substrate (e.g., ceramic, glass), metallurgical barriers, optical reflectors, and thin film-Si (< 50 microns) materials. In addition, to address device issues within film-Si, efforts could be directed at materials issues (e.g., nucleation, film growth, grain boundaries, defects, and impurities) and the interaction of the various layers. Responders shall develop improved understanding of how device development schemes (e.g., buffer layers or graded layers) affect device performance, and may contribute to “closure” regarding issues that have been researched in the past but have so far remained elusive. Fundamental research approaches are welcomed in this task, as well as in all others.

Task 2: Process Improvements and In-Situ Diagnostics and Monitoring

Process improvements for the deposition of the various device layers, such as the transparent conductors, buffer layers, absorber layers, and metal contacts shall be investigated that result in large area, low cost, and high yield for module fabrication. Where suitable substitutes can be found, deposition processes that are deemed complex and/or expensive shall be replaced by those deemed potentially lower cost, higher throughput, and more manufacturable. Issues such as high yield and enhanced throughputs shall be investigated. In-situ diagnostics and monitoring approaches to improve processes shall also be researched and incorporated in deposition systems.

Task 3: Module Design and Fabrication

One of the key processing steps in module fabrication is the development of interconnects for monolithically integrated modules. Laser and mechanical scribing techniques are normally used because of the precise control of these processing steps. Advanced laser scribing techniques shall be investigated, in addition to other scribing methods such as chemical etching, ink-jet printing, etc. Alternately, in order to minimize the number of scribes for interconnects, screen-printed interconnect or other innovative schemes could also be developed and tested.

Task 4: Device Loss Mechanisms, Encapsulation, and Reliability Testing

Various thin film solar cells demonstrate loss mechanisms in operating or environmentally stressed conditions. It is important that these mechanisms be determined and understood, such that substantial improvement can be made in prototype module development. In-depth materials and device testing under various ambient, bias, and temperature conditions shall be undertaken to understand the various mechanisms that result in loss of device performance. It is imperative that the Staebler-Wronski effect in a-Si be investigated to minimize the losses in a-Si modules.

Module encapsulation, such as EVA, is a significant portion of the unit module cost. Alternate low-cost approaches shall be investigated to reduce the module cost. Additionally, any new encapsulation packages shall be tested for losses both indoors and outdoors. The newly developed encapsulation packages shall follow and pass the guidelines established by the Institute of Electrical and Electronic Engineers Standard 1262-1995. It is also recommended that these new encapsulation schemes pass the UL tests.

Task 5: Analysis, Characterization, and Measurements of Advanced Materials and Devices

The appropriate analysis, characterization, and measurements of advanced materials and devices shall be performed using techniques such as Auger, EDAX, ESCA, FTIR, PL, SEM, SIMS, WDS, X-ray, etc., to understand the changes that take place during processing, and consequently improve the device performance. Also, measurements such as absorption, reflection, and transmission losses shall be performed to improve solar cell performance. Such analysis, characterization, and measurements must carry with it the analytic perspective needed to provide significant technical insights for a specific thin film PV technology.

Task 6: Environment, Safety and Health, and Recycling Issues

Environment, Safety and Health (ES&H), and recycling issues are important and priority items for this LOI and shall be addressed for any given thin film PV technology. Only **Technology Partners** are required to address ES&H issues. For a-Si, the safe handling of gases such as diborane, germane, phosphine, and silane shall be addressed. In the case of CIS, hydrogen selenide and hydrogen sulphide gases shall be addressed in detail, while, for CdTe, issues such as safe handling of Cd related compounds in the work place and recycling of spent modules shall be addressed. Such approaches should be comprehensive, in the sense they take into account all of the details necessary for large-scale processing and recycling of thin film modules.

6. QUALIFICATION REQUIREMENTS

There will be a maximum of two (2) awards made under this solicitation to any one (1) organization, however, organizations can participate as lower-tier subcontractors under multiple awards. An exception is that the awardee of the University Center of Excellence award may not receive any other awards; however, the awardee is eligible for unlimited lower-tier subcontract awards. Also, selected awardees in the Technology Partners category may not receive another award within the Technology Partners category, but may receive an R&D Partners award, for a maximum of two (2) awards. Table 2 below summarizes the qualification requirements by category. (See also Table 4 below for information on the total estimated number of awards for each category.)

Initial manufacturing must occur in the United States (U.S.). And, non-U.S. businesses are excluded from responding to this LOI.

NREL and Sandia National Laboratory (SNL), as the two (2) primary members of the National Center for Photovoltaics (NCPV), cannot participate on any LOI response, because NREL and SNL internal research is separately funded. But NCPV thin film researchers shall participate on the National R&D Teams established as a result of this LOI.

Responders may propose in their letters of interest research activities, such as measurements and characterizations, to be performed by or conducted in collaboration with NCPV technical researchers. However, neither the NCPV technical researcher nor the NCPV program management shall make any commitment prior to subcontract award, either orally or in writing, to perform such research activities

or collaborations. References within a proposal to research activities to be performed by or in collaboration with NCPV technical researchers will not be considered, either favorably or unfavorably, during the evaluation of the Responder's proposal. The LOI reviewers will include NREL, private sector, and government technical experts. Responders should ensure that the proposed subcontract effort can be successfully completed and fairly evaluated independent of the proposed research activities to be performed by or conducted in collaboration with NCPV technical researchers.

Further, this LOI envisions that after subcontract awards, the National R&D Teams will coordinate research activities among the successful subcontractors and NCPV technical researchers. The NCPV anticipates that after subcontract awards, the National R&D Teams will coordinate research activities among the successful subcontractors and the NCPV technical researchers. In addition, NREL will perform measurements and characterization on all subcontract deliverables or samples and will provide data to the subcontractor.

Necessary qualifications and award eligibility are summarized in Table 2 below:

| TABLE 2 - QUALIFICATION INFORMATION BY CATEGORY | | |
|--|--|--|
| Category | Who is Eligible to Respond? | Award Eligibility |
| Technology Partners | U.S. businesses can participate as responders or as lower-tier subcontractors. Academic institutions may participate as lower-tier subcontractors as part of company-led Technology Partners . | Subject to maximum of one (1) award. Awardees are also eligible for up to one (1) R&D partner award (and may participate as lower-tier subcontractor for unlimited awards) |
| R&D Partners | U.S. business or academic institutions (as respondents or lower-tier subcontractors.) | Subject to maximum of two (2) awards (and may participate as lower-tier subcontractor for unlimited awards). |
| University Center of Excellence | Academic institutions | Awardee not eligible for other awards (but may participate as lower-tier subcontractor for unlimited awards.) |

Table 3 below shows the minimum price participation required:

| TABLE 3 - PRICE PARTICIPATION REQUIREMENTS | |
|---|--|
| Technology Partners | 50% for large businesses; 30% for small businesses.* |
| R&D Partners | 30% for large and 10% for small businesses*; no price participation required for educational institutions. |
| University Center of Excellence | No price participation required. |

* See Section 17 for small business size standards.

Educational institutions are not required to price participate. Higher levels of price participation are welcome and will receive consideration during proposal evaluation in accordance with Section 10 below. However, in the case of University lower-tier subcontracts proposed as part of **Technology Partner** proposals, the proposed amount for the lower-tiers can be subtracted from the total proposed amount before calculating minimum price participation requirements.

No “in kind” price-participation will be allowed. However, 100% of the price of capital equipment can be used to satisfy price participation requirements. “In-kind” implies that a subcontractor already has the asset on hand, and it was not specifically or initially purchased for this project. Only dollar-for-dollar price-participation will be acceptable. Higher levels of price participation are encouraged as appropriate, and will be rewarded during the evaluation process in accordance with Section 10 below.

Price participation means that a subcontractor or the lower-tier subcontractor shall share a set percentage of the total subcontract or lower-tier subcontract price.

Responders are notified that if they do not meet the minimum required price participation, the Responder, if selected for negotiations, shall be afforded an opportunity to increase its price participation to meet the minimum requirements. If the Responder does not increase its price participation to comply with LOI requirements, the Responder shall be removed from the competitive range. In addition, Responders will not be allowed to lower their proposed price participation percentages during negotiations since additional consideration is given for price participation greater than the minimum required price participation.

7. POTENTIAL SUBCONTRACT AWARD AND AVAILABLE PROJECT FUNDING

Funding for potential awards is based on availability of DOE funding and on programmatic considerations as decided by DOE, NREL, and NCPV. All potential annual NREL/NCPV funding resulting from this competition from the TFPFP will be limited, in accordance with the amounts set forth in Table 4 below, for any single subcontract. The funding limit (NREL/NCPC share) per subcontract applies only to funds coming from TFPFP, independent of other DOE or NREL/NCPV funding such as HiPer PV, Future Generation PV, Manufacturing R&D, etc.

The estimated number of awards NREL intends to make is listed below in Table 4. However, these numbers may vary due to the proposals received and the availability of DOE and NREL/NCPV funds. The technological mix of these awards shall be based on NREL/NCPV needs to ensure technological continuity among the four options (a-Si, CdTe, CIS, film-Si). Depending on the number of technically competitive proposals in each technology, it is NREL’s expectation that there will be at least one (1) and as many as three (3) **Technology Partners** awards per material option (a-Si, CdTe, CIS), unless no acceptable proposal is received within a specific material area. Requirements to ensure technological robustness and continuity in the thin-film options are important elements of the program policy factors. In fact, NREL/NCPV reserves the right to make any number of awards or not to make any awards under this LOI document.

There are no NREL capital equipment funds for companies available under this LOI. Capital equipment is defined as equipment with a unit value of \$5,000 or more, including applicable shipping and installation charges, and having a life expectancy of two years or more. However, relevant capital equipment may be proposed as part of the Responder’s price participation. Universities may propose up to 10% of the total operating funds for capital equipment.

The period of performance for awards is listed in Table 4 below. Annual reviews shall occur to evaluate the progress of the subcontract. Phase funding shall be annually decided, depending on the reviews, and on the availability of funding.

It is expected that the program funding available under this LOI will be approximately \$12 million from NREL/NCPV annually. The estimated breakout for individual awards per category is listed in Table 4 below.

Award information is summarized in Table 4 below:

| TABLE 4 - AWARD INFORMATION BY CATEGORY | | | |
|--|---|--|------------------------------------|
| Category | Estimated Number of Awards | Period of Performance | Annual Funding per Award |
| Technology Partners | Four (4) to nine (9), with one (1) to three (3) per material option | Up to three (3) years, with one-year Phases. | Up to \$1.0 million/year |
| R&D Partners | Twenty (20) to thirty (30) | Up to three (3) years, with one-year Phases. | From \$30,000 up to \$400,000/year |
| University Center of Excellence | One (1) | Up to five (5) years, with one-year Phases. | Up to \$1.2 million/year |

8. COMPETITIVELY SOLICITED LETTERS OF INTEREST USING BEST VALUE SELECTION

This LOI shall be conducted utilizing Best Value Selection that results in the selection of LOIs for potential subcontract award that is most advantageous to NREL based on the **best value combination of (a) evaluated qualitative merit and (b) evaluated price/cost of the LOIs submitted.**

Best Value Selection is based on the premise that, if all LOIs are of approximately equal qualitative merit, award will be made to the Responder of the LOI(s) with the lowest evaluated price/cost. However, NREL will consider selecting an LOI with a higher evaluated price/cost if the LOI demonstrates the difference in price/cost is commensurate with the higher qualitative merit. Conversely, NREL will consider selecting an LOI with a lower evaluated qualitative merit if the price/cost differential between it and other LOIs results in the best value.

9. QUALITATIVE MERIT CRITERIA FOR BEST VALUE SELECTION

The Scope of Interest (see Section 5) and the Qualification Requirements (see Section 6) in this solicitation serve as NREL’s baseline requirements that must be met by each letter of interest.

The qualitative merit criteria below establish what NREL considers the technical factors valuable in an LOI. These qualitative merit criteria are performance-based and permit selection of a higher priced LOI that provides higher qualitative merit.

The following qualitative merit criteria will be used by evaluators to determine the technical value of the letter of interest in meeting the objectives of the solicitation.

The qualitative merit will be weighted in descending order of importance as follows (note that qualitative merit B will be used only to evaluate the Technology Partner LOI responses, but not for the R&D Partners or the University Center of Excellence LOI responses):

A. Technical Quality & Relevance

The extent to which the proposed research has the potential to contribute to DOE and NREL's long-term thin film goals, i.e., the fabrication in the U.S. of stable thin-film modules with efficiencies of 15% made by low-cost, scalable, manufacturable techniques on inexpensive substrates.

- NREL expects each LOI response to propose ambitious, but achievable and realistic goals, within the context of their own resources and those to be provided by the subcontract. Unrealistically optimistic goals (based on a lack of supporting arguments) will be cause for greatly reduced consideration or elimination.

Note: All efficiencies referred to in this solicitation are based on the NREL standard measurement conditions (global AM1.5, 25⁰ C; total-area for cells; aperture-area for modules). Samples produced under resulting subcontract awards shall be delivered to NREL for verification. Use standard conditions to report accomplishments and to project achievable milestones. For a-Si devices, initial efficiencies will NOT be acceptable as either milestones or for measuring deliverables. NREL will accept minimal well-defined protocol for degrading a-Si devices to a stable range. LOI responses must include suggestions for such a protocol. Final protocol would be negotiated prior to subcontract award.

- The extent to which the proposed research is responsive to the OBJECTIVES and the SCOPE OF WORK, Sections 4 and 5 above, for **Technology Partners**, **R&D Partners**, or the **University Center of Excellence** categories.
- The extent to which the research approach has been developed and potential problems have been anticipated in the proposed research, as well as the explanation and soundness of the approaches to be pursued in the proposed research.
- The extent to which the research is related to activities essential to issues listed in the proposed SCOPE OF WORK.

B. Commitment to Near-Term Commercialization (for Technology Partners only):

- The extent to which the proposed effort has been demonstrated to accelerate and improve the likelihood of success of near-term thin-film manufacturing in the U.S. A critical part in the evaluation of this criterion is the Commercialization Strategy, Attachment 1 below. This Qualitative Merit Criteria B does not apply to R&D Partners or University Center of Excellence LOI responses.

C. Capabilities

- The availability, qualifications, and **past performance** (including contractual performance) of the proposed technical and management personnel, as well as the resources, experience, and flexibility of the responder's organization(s).

10. ADDITIONAL FACTOR FOR EVALUATION

In addition to the qualitative merit criteria above, each LOI will be evaluated against the following evaluation factor to determine the competitive range and final negotiation rank order. This factor is not weighted:

- Level of price participation.

11. PROGRAM POLICY FACTORS

NREL will consider the following program policy factors in making its competitive range determination and final negotiation rank order. This is in addition to the Qualitative Merit Criteria (above). These program policy factors are not weighted:

- A. The need to have a mix of Technology and R&D Partners in order to ensure technological continuity and to raise the likelihood of success for thin-film technologies as a whole; the need to adequately support thin-film material options deemed critical to the mid- and long-term success of the Program (CIS, CdTe, a-Si, film-Si); and the need to balance Thin Film Partnership funding among the best technological approaches.
- B. The need to focus emphasis on the most promising technical approaches to meeting the long-term, cost and performance goals.
- C. The need to have an appropriate level of National R&D Team participation and capabilities within the Partnership.
- D. The requirement that initial manufacturing occurs in the United States.
- E. The requirement that only academia and U.S. businesses can respond to this LOI.
- F. The need to maximize competition and diversity of research by **limiting the number of awards per organization** (per Section 6 above) and/or descoping major parts of the proposed tasks from successful LOI responses.

12. PRICE (COST) EVALUATION FOR VALUE SELECTION

After evaluation of the qualitative merit criteria (and additional factors for evaluation), the following price/cost evaluation will be used to determine the best value of the LOI in meeting the objectives of the solicitation.

The combined qualitative merit value will be considered substantially more important than price (cost) however, price (cost) is considered a substantial factor in the evaluation or responses to this LOI.

13. EVALUATION PROCESS

NREL will evaluate LOIs in two general steps:

Step One – Initial Evaluation

An initial evaluation will be performed to determine if all information has been provided for an acceptable LOI. Responders may be contacted only for clarification purposes during the initial evaluation. Responders shall be notified if their LOI is determined not acceptable and the reasons

for rejection will be provided. Unacceptable LOIs will be excluded from further consideration.

Step Two –Discussion and Selection

All acceptable LOIs will be evaluated against the scope of interest and the qualification requirements; the qualitative merit criteria, the additional factors, and program policy factors listed above. Based on this evaluation, NREL will negotiate an acceptable Statement of Work based on a responder’s LOI and will request a cost proposal for the project. As part of this cost proposal, large businesses who have proposed over \$500K will be required to submit a Small Business Subcontracting Plan (derived from FAR 52.219-9.)

14. LOI PREPARATION INFORMATION

- A. Subject to the limitations in Section 6 above, if more than one LOI is submitted, each must be submitted separately and must clearly indicate the category: 1) Technology Partners, 2) R&D Partners, or 3) University Center of Excellence.
- B. Formatting instructions:
- A page is defined as one side of an 8 ½" x 11" sheet of paper.
 - Use a 12-point font.
 - Maintain at least 1-inch margins on all sides.
 - Copies may be either single or double sided.
- D. Submit no more than the maximum number of pages as detailed under Items E and K, below.
- E. Submit a **“Letter of Interest”** in an original AND ten (10 copies) directed toward meeting the requirements of the solicitation. The LOI shall be organized in the following sections:
1. A title page, to include the Request for LOI title and number, proposed project title, name of organization, and principal investigator (with postal address, telephone number, fax number, and e-mail address). The project title should be succinct and capture the essence of your LOI. The title page should also state which category the letter of interest is for: Technology Partners, R&D Partners, or University Center of Excellence.
 2. A technical discussion limited to a maximum of fifteen (15) typed pages (single-spaced) supporting the proposed work. Elements to be addressed should include:
 - A one-page overview that indicates which technology the LOI response addresses and in what capacity, **Technology Partners, R&D Partners, or University Center of Excellence** and that addresses how the LOI response satisfies the qualitative merit criteria listed in Section 9 of this LOI solicitation. Also, this overview should include a statement that if awarded a subcontract, your organization agrees to participate in National R&D Team activities.
 - An outline of research approaches to be undertaken or concepts to be investigated and a time-table for reaching success or to abandon the research.
 - A technical discussion in support of research approaches.
 - A discussion of potential technical difficulties and proposed solutions.

3. A concise Statement of Work, limited to 5 pages, delineating the proposed tasks to be performed during each of the first three years (or for five years for the Center for Excellence). This Statement of Work would form the basis for the statement of work in a potential subcontract.
 4. Statement of expected results, including a detailed breakdown of targeted milestones and deliverables for each one-year Phase, and a proposed schedule for these by year, limited to two (2) pages.
 5. Description of facilities available to perform the proposed research. Environment, health and safety issues must be addressed.
 6. A selected list and brief description of Government or NREL contracts or subcontracts related to the field covered by this LOI that the Responder has been awarded in the past five (5) years, to include the contracting agency's name, the contract or subcontract amount, and a brief description of the project.
 7. Abbreviated resumes (one page maximum) of one (1) or two (2) Key Personnel .
 8. For **Technology Partners** only, submit a Commercialization Strategy, see Attachment 1 below, along with supporting discussion. This is limited to three (3) pages, and is not part of the final page number restriction of thirty (30) pages (see below).
- F. Submit a completed **Price/Cost Estimate Sheet** (Estimated Budget Form) in an original and ten (10) copies. The price/cost estimate should include support documentation for all categories of the proposed budget and include totals for each year and the total of all years. Your estimated budget and delivery terms must be valid for 190 days from the date of your LOI.
- G. A sample subcontract, specific to this solicitation, may be downloaded from: <http://www.nrel.gov/contracts/rfps/>
- H. This solicitation DOES NOT allow for the submittal of facsimile or electronic LOI responses.
- I. This solicitation does not commit NREL to pay costs incurred in the preparation and submission of a response to this request for LOI.
- J. In addition, LOI responses must include one (1) original (no copies necessary) of the following:
1. Completed "Representations and Certifications"
 2. Acknowledgments of all amendments to this solicitation. **Amendments will be posted on this web site - you must download/print the acknowledgment form for all amendments, sign, and enclose with your LOI response.**

- K. **The total LOI response, including any attachments or appendices, is limited to thirty (30) pages (not counting the Commercialization Strategy, Representations and Certifications, Amendment Acknowledgments, and Estimated Budget Form).** Relevant references may be cited, but do not include copies of referenced articles in the submission. Identify, if you wish, no more than ten (10) selected publications of the principal investigator(s). **Note that all submissions are restricted to specified format.**

15. SOLICITATIONS PROVISIONS

A. Late submissions, modifications, and withdrawals of LOIs

LOIs, or modifications to them, received from qualified organizations after the latest date specified for receipt may be considered if received prior to selection, and NREL determines that there is a potential budget, technical, or other advantage, as compared to the other LOIs received. However, depending on the circumstances surrounding the late submission, NREL may consider a late LOI to be an indication of the respondent's performance capabilities, resulting in downgrading of the LOI by NREL evaluators in the technical evaluation process. A LOI may be withdrawn by written notice or telegram (including mailgram) received at any time before selection. A LOI may be withdrawn in person by a Responder or an authorized representative, if the representative's identity is made known and the representative signs a receipt for the LOI before selection.

B. Restrictions on disclosure and use of data

Responders who include in their LOIs data that they do not want disclosed to the public for any purpose or used by the government or NREL, except for evaluation purposes, shall --

1. Mark the title page with the following legend:

"This LOI response includes data that shall not be disclosed outside the Government or NREL and shall not be duplicated, used, or disclosed--in whole or in part-- for any purpose other than to evaluate this LOI. If, however, a subcontract is awarded to this responder as a result of--or in connection with--the submission of this data, the government or NREL shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting subcontract. This restriction does not limit the government or NREL's right to use information contained in this data if obtained from another source without restriction. The data subject to this restriction are contained on pages [*insert page and line numbers or other identification of pages*]"; and

2. Mark each page of data it wishes to restrict with the following legend:

"Use or disclosure of data contained on this page is subject to the restriction on the title page of this LOI."

C. Notice of right to receive patent waiver (derived from DEAR 952.227-84) and technical data requirements.

Responders (and their prospective lower-tier subcontractors) in accordance with applicable statutes and Department of Energy Acquisition Regulations, (derived from DEAR 952.227-84) have the right to request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of the subcontract that may be awarded as a result of this solicitation, in advance of or within thirty (30) days after the effective date of subcontracting. Even where such advance waiver is not requested or the request is denied, the subcontractor will have a continuing right during the subcontract to request a waiver of the rights of the United States in identified, individual inventions.

Domestic small business firms, educational institutions, and domestic nonprofit organizations normally will receive the Patent rights clause—retention by the subcontractor—which permits the responder to retain title to subject inventions, except in subcontracts involving exceptional circumstances or intelligence activities. Therefore, domestic small business firms, educational institutions, and domestic nonprofit organizations normally need not request a waiver.

If a responder's proposal includes a lower-tier subcontract to another organization, that lower-tier organization's business type will determine the applicable intellectual property provisions that will apply to the lower-tier subcontract. Note that a lower-tier subcontractor may apply for a patent waiver under the same conditions as the responder.

Under a research, development, and demonstration project, the Department of Energy and NREL are unable to ascertain, prior to receipt of LOIs, subsequent proposals, or performance of the project, their actual needs for technical data. It is believed that the requirements contained herein are the basic needs of the Department of Energy and NREL. However, if the responder indicates in its LOI or subsequent proposal that proprietary data will be used or withheld under its proposed effort, the government and NREL reserve the right to negotiate appropriate rights to the proprietary data. The appropriate rights may include "Limited Rights in Proprietary Data" and/or "Subcontractor Licensing."

D. Disclaimer

NEITHER THE UNITED STATES, NOR THE DEPARTMENT OF ENERGY, NOR MIDWEST RESEARCH INSTITUTE, NATIONAL RENEWABLE ENERGY LABORATORY DIVISION, NOR ANY OF THEIR CONTRACTORS, SUBCONTRACTORS, OR THEIR EMPLOYEES MAKE ANY WARRANTY, EXPRESSED OR IMPLIED, OR ASSUME ANY LEGAL LIABILITY OR RESPONSIBILITY FOR THE ACCURACY, COMPLETENESS, OR USEFULNESS FOR ANY PURPOSE OF ANY OF THE TECHNICAL INFORMATION OR DATA ATTACHED OR OTHERWISE PROVIDED HEREIN AS REFERENCE MATERIAL.

E. Solicitation disputes

The General Accounting Office and the Department of Energy do not accept or rule on protests for solicitations for Letters of Interest issued by Management and Operating Contractors for the Department of Energy (operators of Department of Energy National Laboratories). Should a responder have any concerns regarding the NREL solicitation process or selection determination, the responder may contact Marty Noland, Advocate for Commercial Practices at (303) 384-7550. NREL will address each concern received from a responder on an individual basis.

16. SOLICITATION PROVISIONS – incorporated by reference–general access

This solicitation incorporates one or more solicitation provisions by reference with the same force and effect as if they were given in full text. The following documents can be downloaded from the NREL general access website at: http://www.nrel.gov/contracts/rfp_related_docs/

- A. NREL Representations and Certifications for Subcontracts
- B. NREL Estimated Budget Form

17. NAICS CODE AND SMALL BUSINESS SIZE STANDARD

- A. The North American Industry Classification System (NAICS) code(s) [formerly standard industrial classification (SIC)] for this solicitation is 54171.
- B. The small business size standard for 54171 is 500 or less employees.

Attachment 1

Commercialization Strategy

Instructions

A proprietary Commercialization Strategy must be included in the LOI for competition in the **Technology Partners** category. It should be a well-considered, good-faith projection of the Responder's strategy for commercializing thin-films. It must be stamped "proprietary." Due to its proprietary nature, it will be included in any final subcontract by reference only. The Commercialization Strategy will be a critical item used to judge the potential value of the LOI response in the **Technology Partners** category. We seek aggressive, but realistic plans that demonstrate the size and credibility of the Responder's commitment to translating technical progress into future products. The strategy should be written to include plans and critical issues concerning: scale-up, first-time manufacturing, product design and introduction, product introduction and marketing plans, ES&H, and financial risks and requirements. Other aspects may be addressed as appropriate.

The page limit of the entire LOI (30 pages) does not apply to this item, however, the Commercialization Strategy is limited to an additional three (3) pages.